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## Sap flow dynamics of navel orange trees [*citrus sinensis* (*L*) *Osbeck*] with partially stressed root zones in northeast Zimbabwe

S. Dzikiti (1), K. Steppe (2), R. Lemeur (2), J.R. Milford (1), F.X Meixner (1,3)

(1) Agricultural Meteorology Group, Physics Department, University of Zimbabwe, Zimbabwe, (2) Laboratory of Plant Ecology, Ghent University, Belgium, (3) Max Planck Institute for Chemistry, Biogeochemistry Department, Mainz, Germany (sdzikiti@science.uz.ac.zw, kathy.steppe@Ugent.be / Fax: +263-4-307-156)

Accurate estimates of water use are crucial in citrus orchards in the arid and semi-arid tropics where production relies heavily on irrigation. Water use by navel orange trees [*Citrus sinensis (L)* Osbeck] was measured in different soil drying treatments both in laboratory conditions using young potted trees and in field conditions in a mature orchard in Zimbabwe. Water flow through the young potted trees was monitored using sap flow sensors installed at stem and branch level of selected trees. Similar measurements were taken on mature bearing trees under field conditions. Both the laboratory and the field experiments revealed that the overall level of water use was quite constant during the entire day, which points towards a tight stomatal regulation of the transpiration rate. Most interestingly, transpiration and consequently stem diameter and leaf surface temperature followed cyclical oscillations with varying periodicities throughout the day. Subjecting the whole root zones of the young laboratory trees to water stress caused a maximum water extraction from the internal storage reserves (up to 10 % of the total daily transpiration) and a maximum stem diameter shrinkage of approximately 150  $\mu$ m. Less water (4 % of the total daily transpiration) was derived from the internal storage for well watered trees with maximum stem diameter shrinkage of about 100  $\mu$ m. Partially stressing the root zones of the orange trees in both laboratory and field conditions resulted in reduced daily total water use. Moreover, no significant reduction in stem and fruit growth rate was observed indicating a possibility for increased water use efficiency when the trees are subjected to partial water stress of the root zone.